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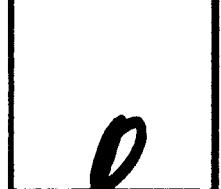
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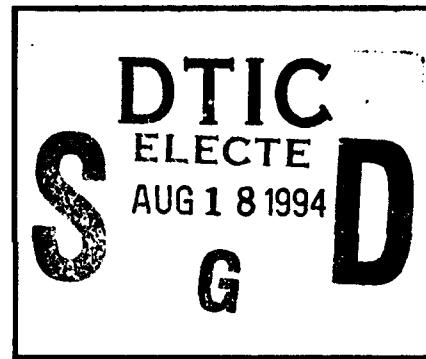
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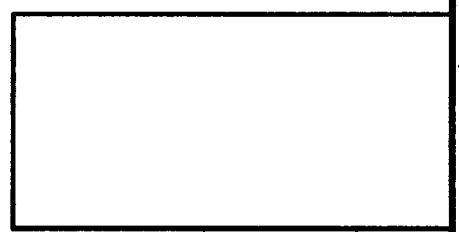
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Report 1172

INTERIM REPORT

DEVELOPMENT OF LITHOGRAPHIC OFFSET PRESS  
22- BY 29-INCH, SHEET SIZE

Project 8-35-09-002

16 June 1950

Submitted to

THE CHIEF OF ENGINEERS, U. S. Army

by

The Commanding Officer  
Engineer Research and Development Laboratories

Prepared by

Thomas J. Hepler  
Photo-Litho Branch  
Engineer Research and Development Laboratories  
Fort Belvoir, Virginia

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INTERIM REPORTDEVELOPMENT OF LITHOGRAPHIC OFFSET PRESS22- BY 29-INCH, SHEET SIZE

## I. INTRODUCTION

1. Subject. This report covers the development and testing of an experimental, lightweight, single-color, lithographic offset rotary press, of 22- by 29-inch sheet size for the reproduction of military maps and charts, and designed to be readily adaptable to movement by motorized mapping van or by aircraft.

2. Authority. This work was conducted under the authority of Project 8-35-09-002, Press, Lithographic, Offset, 22 $\frac{1}{2}$  by 29-inch. A copy of the project card for this development (RDB Form 1A) is contained in Appendix A.

3. Personnel. The initial work on this development was accomplished by William C. Cude, Chief, Topographic Engineering Department, and Robert E. Rossell, Chief, Photo-Litho Branch, ERBL, Fort Belvoir, Virginia. Inspection and tests were made by Thomas J. Hepler, Project Engineer.

4. Background. The need for lightweight, compact map reproduction equipment, capable of being transported by air or truck, was clearly demonstrated during World War II. The commercial standard presses then in use were bulky and heavy, and had to be disassembled when moved. This meant valuable time lost, and in many instances, the movement was accomplished too late to keep pace with the fast moving military groups. The experimental press was initiated to meet this requirement.

When it was first decided to develop the new press, a primary aim was to reduce the weight, which for the press then in use amounted to 6600 pounds. In developing the new press, weight reduction was to be accomplished by means of unitized construction plus the reduction in the number of ink rollers employed and elimination of the ink drum. Unitized construction proved to be an excellent approach to the saving of weight and as a result, it was decided to work toward the goal of a press having transportability without sacrificing printing quality.

## II. INVESTIGATION

5. General. Contract No. W-44-009 eng-405 was awarded to American Type Founders Sales Corporation, Webendorfer-Wills Division, Mount Vernon, New York, on 3 June 1946, for the design and construction of an experimental model lithographic offset press (Fig. 1). The procurement specifications for this contract, including the revisions made during the design and manufacture of the press, are shown in Appendix B.

The press was operated by the manufacturer, using standard plates and paper furnished by the Laboratories, and shipped to ERDL, where it arrived in June 1948. All investigations completed at the factory by the manufacturer were verified in the laboratory and the press was accepted by ERDL.

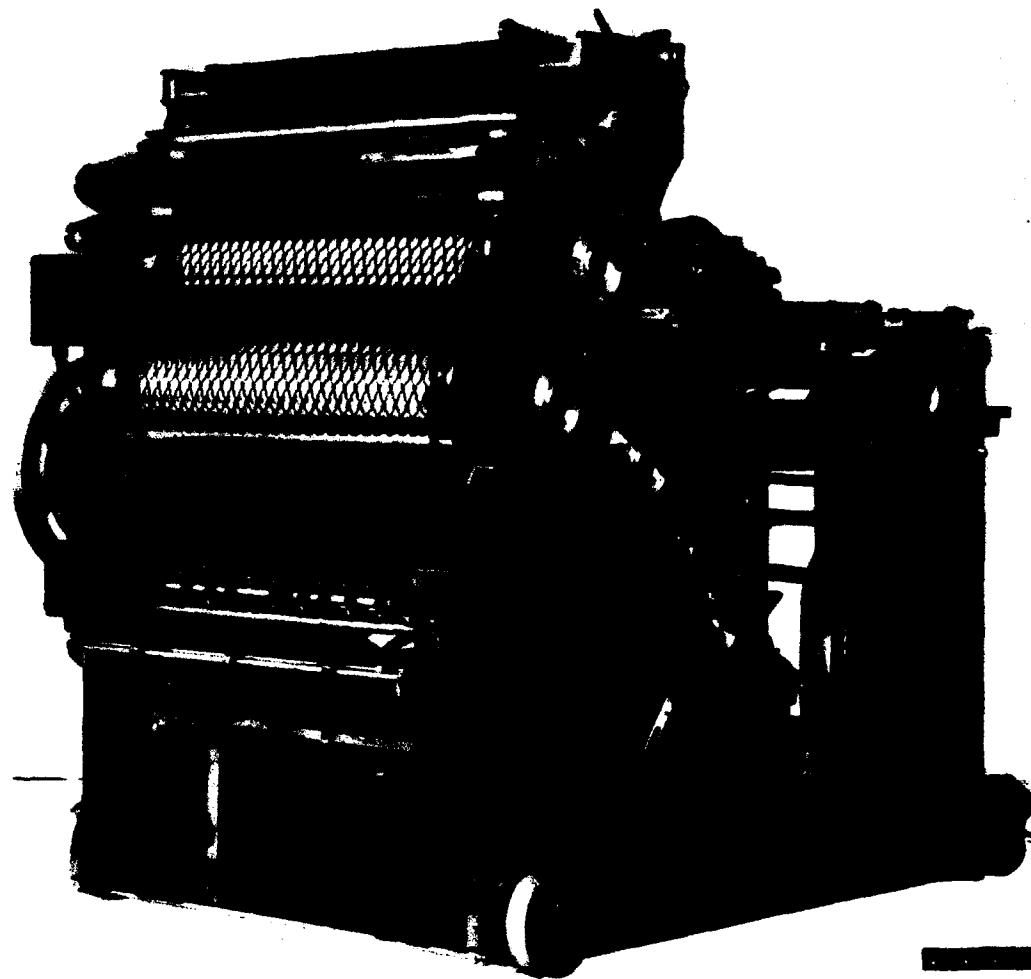
After 10 months of operation in the laboratory during the period from June 1948 through March 1949, the press was loaded into a standard Army truck and transported, fully assembled, to the Army Map Service for production testing. With completion of the production tests, which required approximately 2 weeks, the press, fully assembled, was again loaded and transported by truck back to the laboratory.

6. Description. The experimental press as shown in Figs. 1 and 2 is both smaller and lighter than the current standard Army press (Engineer Stock No. 54-8450.220-290), which is a modified commercial press (Webendorfer Big Chief Model 29). The principal dimensions are compared in the following list:

<u>Item</u>	<u>Standard</u>	<u>Experimental</u>
Length	89 in.	73 in.
Height	72 in.	60 in.
Width	60 in.	59 in.
Weight	6600 lb	4200 lb
Floor space required	35 sq ft	30 sq ft
Cubage	225 cu ft	150 cu ft

The press consists of the following major assemblies, as indicated in Fig. 2: base and side frame (A); feeder (B); conveyor board (C); impression cylinder (D); blanket cylinder (E); plate cylinder (F); inking system (G); dampening system (H); delivery (I); electric drive motor (J); and feeder air pump and motor (K).

The weight reduction was accomplished by using a steel plate frame construction and reducing the number of rollers used in the ink distribution system from 18 to 14. Of special interest is the elimination of the large ink drum in the ink distribution system.



206-2-7

Fig. 1. Delivery end of experimental, lightweight, lithographic offset press having a 22- by 29-in. sheet size.

The frame construction of the press represents a distinctive departure from the conventional use of heavy metal castings. The frame, and supporting skid, is made from  $\frac{1}{2}$ -inch steel plate and has additional blocks, bars and plates for bearing supports, spacing or reinforcement welded and machined to close tolerance requirements. The frame and supporting skid is welded into a "U" shape, so that the entire press, fully assembled from feeder to delivery, can be moved as a unit.

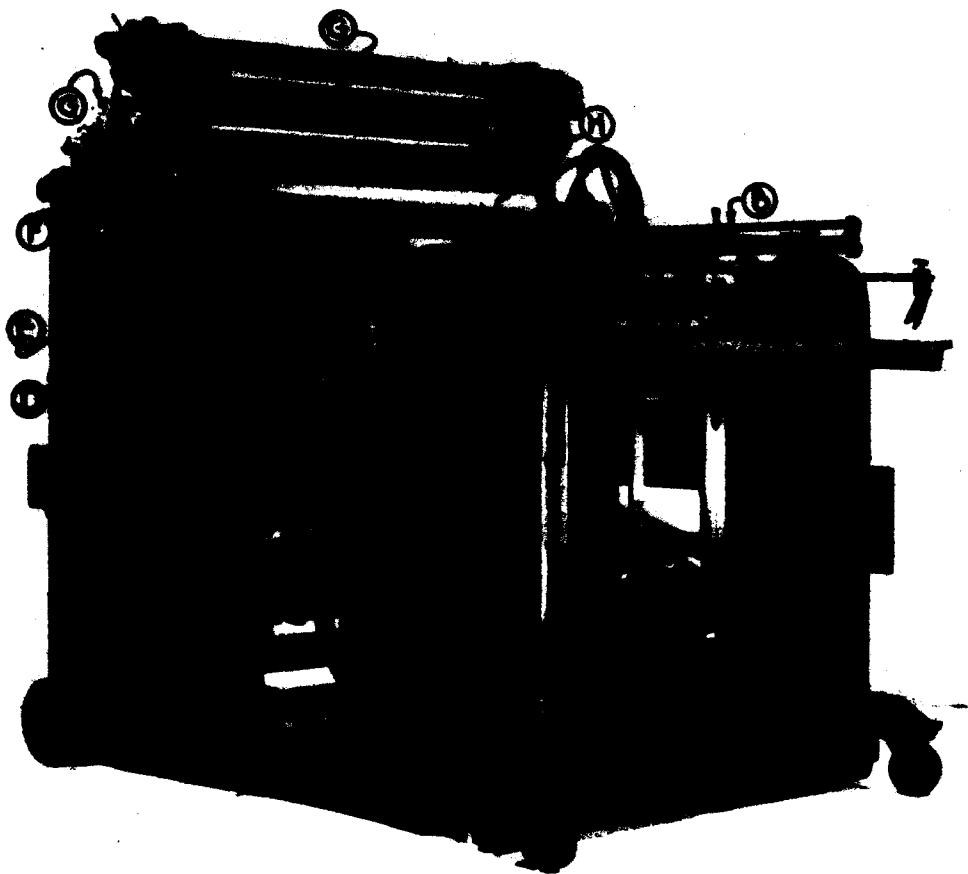
In addition, two wheels mounted on permanent axles at the delivery end of the press, plus the two swiveling caster wheels at the feeder end, simplify movement so that neither special erection personnel nor special devices are required to reset and position the machine. Once in position, all four can be detached and the press lowered to the floor for operation by means of four jack screws. A diagram showing the major parts and over-all dimensions is given in Fig. 3.

7. Engineering Tests and Results. Engineering tests were conducted at ERDL to determine the performance characteristics and operational characteristics, with respect to registration, image, size, quality of reproduction of the press, and readability. A calibrated ink fountain which replaced the one furnished was also tested. Standard inspection procedures were used to check the performance characteristics of the press. These consisted of the examination and measurement of the press, plus a series of test runs using stocks of paper of various sizes, thicknesses, and qualities. Press runs up to 10,000 sheets were made as required to establish the capability of the press to handle a given size of paper or type of stock.

a. Registration. In all tests, the sheets were run through the press twice and checked for line overprint and thickness of the combined line.

(1) First run. The first test run was made at 3,000 impressions per hour, with 100 sheets being run through the press twice and checked for line overprint. Deficiencies in register were found; hence, a thorough checking of each part of the press which had bearing on maintaining accurate register was made. Each part was progressively checked and test runs repeated until the front guides were reached. Here, it was observed that because of the paper hold-downs, the paper was buckling or curling at the front guides.

When subsequent test runs indicated the necessity for modification of the four paper hold-downs, they were removed from the front guides and modified to allow adjustment to an absolute minimum of clearance without depressing



206-2-9

Fig. 2. Major parts of experimental lithographic offset press. Letter A shows steel plate permitting unitized construction. For description of other parts, see text (par. 6).

the guide tongues. The modification consisted of heating the springs, bending the narrow part of the finger end 45 degrees from the original axis and heat-treating them to restore their original temper. The hold-down fingers were reinstalled, set to .005-inch clearance with the guide tongues, and the tests were resumed.

(2) Second run. During the second test run, 478 copies were run through the press twice, following which the results were checked sheet by sheet with a magnifying glass for line overprint. Of the 478 copies reproduced, 330 were in accurate register, and 148 off-register.

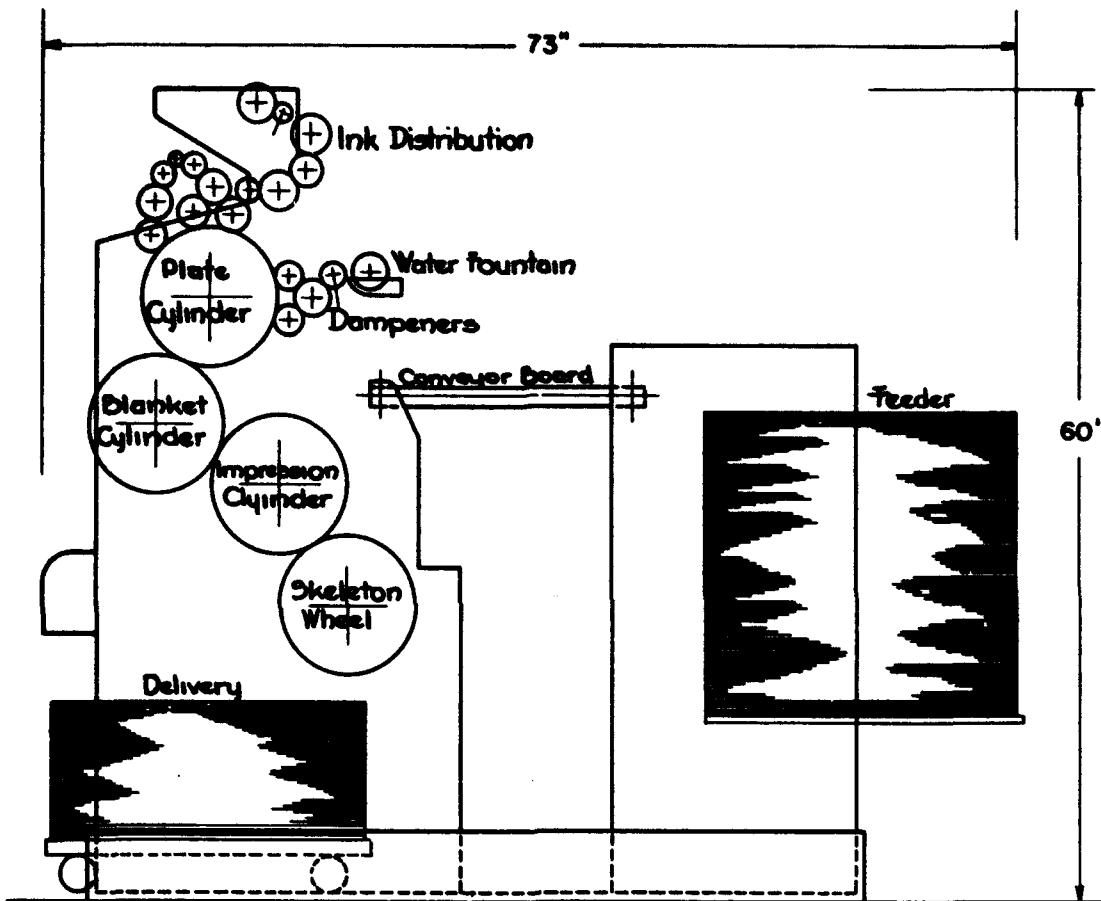
Although the results were an improvement over those of the first run, it was not considered that the optimum accuracy of registration had been achieved. For this reason, further investigation was made, and it was observed that all portions of off-register were localized on the corner of the sheet next to the operator's side of the press. When the outside paper hold-down on the operator's side was removed, inspection revealed that during the modification, a crack had occurred approximately half-way across the surface that contacted the paper, and that the crack had protruded far enough below the normal spring surface to set up a frictional resistance to the paper.

(3) Third run. When the crack was repaired, the hold-down was reinstalled, set to .005-inch clearance and the third test run was undertaken. In this run, 100 copies were run through the press twice and examined under a magnifying glass, and 99 of the sheets were found to be accurately registered.

(4) Fourth run. For the final test runs, the operating speed was varied. Utilizing increments of 250, the press was tested through the range of 3,000 to 5,000 impressions per hour.

Every tenth printed sheet was extracted during each speed increment. Comparisons were made by measuring line thicknesses at selected points on the sheets with a Bausch & Lomb 40X shop microscope, the single printed sheets being checked against the double or overprinted sheets. The variations in registration, fell within the tolerance defined as accurate register,<sup>1</sup> and never exceeded .01 inch.

1. Walter E. Soderstrom, The Lithographers Manual (New York: 1940, Waltwin Publishing Company), p. 231.



206-2-26

Fig. 3. Schematic drawing of experimental lithographic offset press showing relationship of ink rollers, dampening rollers, and cylinders.

b. Image Size. The image size on the printed sheet was checked with a microrule against measurements taken from the plate before its installation on the press. In measurements made across the two ends (that is, across the 22-inch dimension of the sheet) the image sizes were found to be 20.031 and 20.035 inches on the paper against 20.016 and 20.026 inches on the plate, respectively. This represents a maximum difference of .015 inch between the plate image and that on the reproduction, and falls within the tolerance of .04 inch expected under commercial operating conditions.<sup>2</sup> During this phase of engineering tests 20,000 impressions were run.

c. Quality of Reproduction. Quality of reproduction is determined by observation, since no instruments are available for its determination, but generally, it is based on sharpness of impression and color rendition. Sample sheets were extracted at random on all kinds of material printed by the press, and comparisons were made by visual inspection and standard color patches with reproduced map and mosaic material obtained from other lithographic offset presses, such as the Harris LSB and LTE, and the EBCO. It was the opinion of the operating personnel and the project engineer that the quality of reproduction equalled or bettered that of the other presses.

d. Roadability. The three separate tests of the roadability of the press were each preceded and followed by a press run of standard printed matter.

(1) After the fabrication of the press was completed at Mt. Vernon, New York, by Webendorfer-Wills (a division of American Type Founders Sales Corporation), it was shipped completely assembled via standard Army mapping van to ERDL. The distance traveled was approximately 300 miles. After the press arrived at ERDL, it was rolled intact from the truck into the pressroom of the Photo-Litho Branch. No readjustment or alignment was required as a result of this move.

(2) After 10 months of operation at ERDL, the press was again loaded intact onto a standard 2½-ton Army truck, fully assembled, and transported 30 miles to the Army Map Service for production testing. Again, no adjustment as a result of the move was found necessary.

(3) The same situation obtained after the return of the press, via truck, to the ERDL from the Army Map Service.

2. Robert F. Reed, The Register Rule, (New York, Lithographic Technical Foundation Inc., Research Series No. 2, 1936), p. 10.

8. Deficiencies and Modifications. All deficiencies noted during the engineering tests are summarized in Table I. Two modifications, which did not alter the basic design of the machine, were made: a calibrated ink fountain was installed, and the wire safety guards were replaced by plastic guards. The need for minor design changes or rearrangement of components was noted, but the changes were not made because of the expense involved. However, these, together with the modifications noted previously, were included in the purchase description prepared for the procurement of service test models (see Appendix C).

With regard to the calibrated ink fountain (see Fig. 4), operational tests involving 5000 impressions were conducted to determine whether it provided greater control of ink distribution, and whether this increased the ease of duplicating a press run or affected the quality of printing.

The calibrated ink fountain, a modified version of the standard fountain, includes the following additional features:

A fixed position for the ink blade.

Cams activated by thumb-screws instead of the direct contact of the thumb-screws to regulate the opening between the ink blade and ink fountain roller.

A calibrated dial for each thumb-screw to enable the operator to repeat specific job requirements.

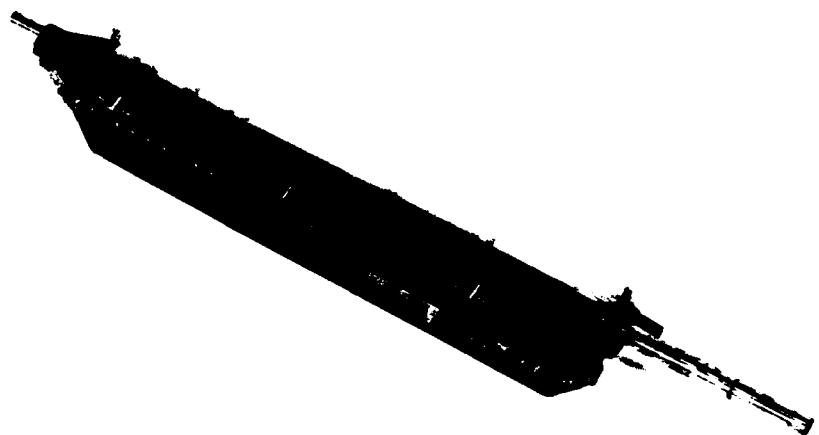
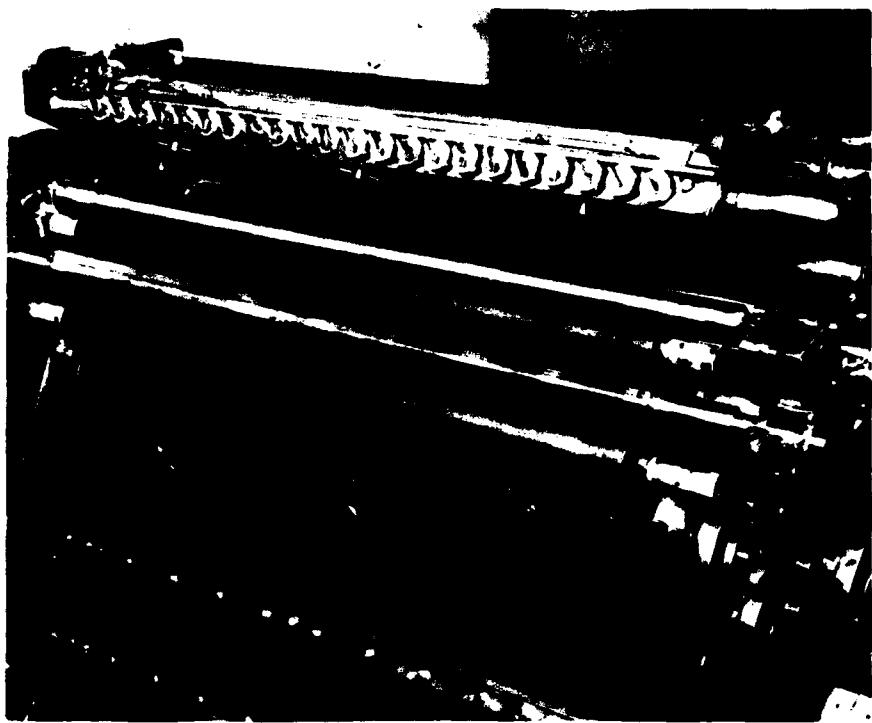
A reduction in the number of adjustment screws from 29 to 22.

These tests were made over a period of 2 days, with intervals of 2 hours between runs. During the time between runs, the adjustment screws were opened to their maximum and returned to the original recorded readings just before the resumption of the next test run.

After each 2-hour interval, 500 impressions were run and were compared visually with the results obtained on the initial run. No variations with respect to ink distribution could be detected on the subsequent runs, and the time required for setting was found to be noticeably less than that required for the standard fountain.

Table I. Deficiencies Noted During Engineering Tests

Item	Deficiency	Remarks
Paper hold-downs	Paper hold-down springs could not be adjusted for thin stock without causing guide tongues to malfunction.	Tip of paper hold-down bent up at 45-degree angle.
No-sheet detector	In its present position, 5 in. behind front guides, detector permits paper to be fed far enough down conveyor board to prevent detector from tripping "off impression," but not far enough to feed paper into press.	Move no-sheet detector from its present location to gripper edge of conveyor board, incorporating it with front guides.
Ink distribution anchor assembly	Present design of ink distribution anchor assembly permits lateral vibration of ink distribution system and results in a roller streak about every third printed sheet when halftones are being reproduced without safety guard firmly affixed in position.	Spreader bars or gibs should be inclined to anchor ink distribution assembly to side frames to give greater stability.
Plate cylinder	Lacks calibrated indicator for accurate determination of movement of plate cylinder in setting register, or position of image on paper.	Calibration of plate cylinder for positioning printing on paper should be provided.
Impression cylinder grippers	Solid type grippers; any damage to one gripper causes other grippers to malfunction.	Provide individually sprung impression cylinder grippers.
Ink fountain trip	Manually operated ink fountain trip continues to feed ink when press is running "off-impression".	Provide automatic ink fountain trip which will prevent flow of ink from fountain when press is "off-impression" or when it is tripped.
Dampening system	Dampener rollers (covered with first and second flannel plus the outside covering) become water-soaked and delay moisture control when plate is changed frequently.	Provide synthetic rubber-covered rollers with a single covering of Aquatex or mohleton.
Manual pile raising mechanism	Present hand wheel of 6 3/4 in. too small to give operator leverage to raise fully loaded feeder.	Provide square-jawed clutch coupling lever or wheel of suitable diameter with free turning handles.
Blanket and plate dimension	Cannot carry registration marks when using maximum sheet size; and undercutting of packing under plate and blanket needed when using maximum sheet.	Modify cylinders to accommodate plate and blanket size of 27 by 29 $\frac{1}{2}$ in.
Ink fountain ratchet	Present position of ratchet awkward for right-handed operator.	Move ratchet to left side of fountain as one faces delivery end of press.
Adjustment of ink fountain	Standard ink fountain settings attained by trial and error; no record possible.	Modified by installation of calibrated ink fountain. Provide future models of press with calibrated ink fountain.
Wash-up attachment	Detachable wash-up attachment requires excessive time of attachment and removal.	Provide permanently installed wash-up attachment equal to Baldwin type as manufactured by William Gegenheimer, Brooklyn, N. Y.
Air-vacuum control	No gage for determining air-vacuum pressure; valve not adapted to precise control.	Provide needle valves for precise control; and gages for visual determination of pressures.
Safety guards	Wire safety guards over cylinders permit objects to fall into press; hindered visibility.	Provide transparent plastic (acrylate or methacrylate) guards over cylinders and inking mechanism.



206-2-31  
206-2-29

Fig. 4. Top: Calibrated ink fountain which was tested as part of the experimental press. Bottom: Standard ink fountain originally furnished on press.

## III. DISCUSSION

9. Evaluation. The press met the military requirements of simplicity, ruggedness, compactness, transportability, lightness in weight, and easy installation into a mobile mapping van. The effect of the unitized construction of the press is reflected in the ready accessibility to all operating components and the incorporation of the feeder and main press components into a single unit. Approximately 900,000 impressions were run from the press during the 17 months of the test period. In all of the runs made the results obtained from the press were found to be equal to those produced on current Army or commercial standard presses, and the operating characteristics were reported to be satisfactory.

Specific factors in its performance are its printing characteristics, operating characteristics, and transportability. These are discussed in subsequent subparagraphs.

a. Printing Characteristics. One of the most important considerations in the evaluation of a lithographic press is the accuracy of register. In this essential requirement, the experimental press is equal to or better than the standard press. Consideration was given to substituting a stream feeder for the sheet-by sheet feeder to obtain accuracy of register at speeds above 4,000 impressions per hour, but it was determined that this would increase the over-all length of the press by approximately 8 inches, the net weight by at least 200 pounds, and would increase the cost and maintenance problems to a degree that would offset any advantage to be gained. The quality of printing, judged on the basis of sharpness of impression and its trueness to the color being reproduced, was found to be excellent. The production rate, influenced by the ease of changing plates, time required to obtain proper lay of print on the paper, and the percentage of acceptable reproductions, was highly satisfactory. The calibrated ink fountain functioned well, providing an even, over-all ink coverage. Since its installation in June 1949, it has remained in constant operation with excellent results and maintains uniformity of results by means of the standardized setting procedure.

b. Operating Characteristics. From the viewpoint of military use the operating characteristics of a press must be such that semi-trained personnel of limited experience may be utilized at times. During the tests, three lithographic pressmen-trainees operated the press satisfactorily after a short period of instruction and produced a good quantity of usable printed matter. During the production runs at the Army Map Service, the press was operated by experienced pressmen. Both experienced and semi-trained personnel remarked that the press had over-all simplicity and was readily accessible for adjustment of control parts.

c. Transportability. No operating deficiencies or damage to the press were observed as a result of 350 miles of transport over first- and second-class roads.

Use of the steel plate in place of the normal frame appears to present no disadvantage and, in fact, seems to make a stronger press than does the standard construction. For shipments which may subject the press to shocks and twisting strains not encountered in normal usage, the use of steel plate is considered to be a distinct advantage.

For field use the unitized construction, in which the press is built as a single unit supplied with wheels and lifting attachment, saves time and labor, since it allows the press to be placed quickly into a truck, or other means of transport without first being disassembled by specialists. Thus, orders to move the press can be put into effect and loading can be accomplished in a minimum of time. Presses currently standard not only require time-consuming disassembly, but are much more difficult to load when disassembled.

Also, as a result of the unitized construction, the weight is reduced from 6600 to 4200 pounds. Despite the elimination of more than one ton in the total weight, the press is equal in all respects to the heavier model from which it was patterned. Elimination of three ink rollers and the large ink drum, normally employed on presses of this type, was accomplished without sacrifice of ink distribution, or quality of reproduction obtained. In addition, the lighter unitized construction results in a saving in cubage of 75 cubic feet, while the floor space required is reduced by approximately 5 square feet.

Tests to determine whether the press could be loaded and transported by air were not made. However, the weight (4200 pounds) and dimensions (73 inches long by 59 inches wide by 60 inches high) are such that it can be carried in Phase II Operations. (For Type C-119B Aircraft the maximum limitations of material are: weight, 20,000 pounds; length, 37 feet 6 inches; width, 8 feet 8 inches; and height, 7 feet 9 inches.)

10. Compliance with Military Characteristics. The engineering tests have shown that, while there are some minor deficiencies in the design of the press tested, it complies with the requirements of the approved military characteristics, except as indicated in Table II. The press was not checked for compliance with those additional military characteristics which are now standard for all types of military equipment. These include resistance to extreme temperature conditions, radio suppression, and tropicalization.

Table II. Compliance with Military Characteristics

Military Characteristics	Comment
Integral design of the press and feeder on a light through rugged frame, skid mounted, and having a low center of gravity.	Entire press is fitted into a welded U-shape frame and skid so that it can be moved as a single unit. Over-all height of press is 60 in., a reduction of 13 in. compared to current standard Army press of this capacity, with a proportional lowering of center of gravity.
Over-all dimensions approximately 51 in. wide, 48 in. long, 58 in. high.	Over-all dimensions are 59 in. wide, by 72 in. long, by 60 in. high. Press will easily fit in the standard map reproduction van, and meets the requirements of Phase II airborne operations. Any further reduction in size would have required development of a radically different design.
Approximate weight 3600 lb.	Weight is 4200 pounds, which is 2400 pounds less than that of standard Army model press of this capacity. Any further reduction in weight would entail redesign of basic components in lightweight metals with an accompanying probable reduction in durability and capacity.
Sheet size $22\frac{1}{2}$ - by 29-in. maximum, 11- by 17-in. minimum.	Meets requirement.
Printing size $21\frac{5}{8}$ by 28 in.	Exceeds requirement. Maximum printing size is $22\frac{1}{8}$ by $28\frac{1}{2}$ in.
Stock range from 9-lb onionskin to 6-ply card stock.	Meets requirement.
The press shall be suitable for the reproduction of topographic and photo maps or similar line and halftone subjects, in printing in single or multicolor (by successive printings) in hairline register by the offset lithographic process. The headstop shaft and all headstops to be made adjustable as one piece. An arrangement for swinging the printing plate for register without removing the plate clamps to be included.	Meets requirement.
Variable speed drive from 3000 to 5000 sheets per hour.	Meets requirements.

This type of equipment in use is normally operated in a van or approved type of shelter in which ambient temperature must be within range of 50 to 125 F. Provisions are being made in plans for future procurement for necessary tropicalization and radio suppression of appropriate components of the press.

The approved military characteristics with regard to overall dimensions and weight were originally established as target figures, with a view to air transport in C-47 aircraft. During the actual development of the press, it was found impossible to conform to the dimensions and weights specified without undertaking the design and development of a radically different press. This would have materially increased the costs and would probably have required additional experimental models. Similarly, a further reduction of weight of the press from 4200 to 3600 pounds would require the extensive use of lightweight metals and alloys, which would be a deviation from standard commercial practices for this type of equipment, and would have entailed additional experimentation. Also, an additional 600 pounds does not appreciably alter the gross weight (13 tons) of the motorized press section of the mapping train, and does not affect its applicability to airborne operations.

#### IV. CONCLUSION

11. Conclusion. It is concluded that, with the exceptions noted, the experimental model lithographic offset press conforms to the approved military characteristics, and, when modified as indicated in the report, is suitable for service test.

#### V. RECOMMENDATION

12. Recommendation. It is recommended that a lithographic offset press incorporating the modifications found desirable in the engineering tests, be procured and service tested.

Submitted by:

Thomas J. Hyler Jr.

THOMAS J. HYLER  
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Forwarded by:

Robert E. Russell

ROBERT E. RUSSELL  
Chief, Photo-Litho Branch

Approved 16 June 1950 by:

William C. Cude

WILLIAM C. CUDE  
Chief, Topographic Engineering  
Department

APPENDICES

<u>Appendix</u>	<u>Subject</u>	<u>Page</u>
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## APPENDIX A

## **AUTHORITY**

2025 RELEASE UNDER E.O. 14176 - UNCLASSIFIED

2025 RELEASE UNDER E.O. 14176 - UNCLASSIFIED

SECURITY CLASSIFICATION - UNCLASSIFIED

c. MILITARY CHARACTERISTICS (Continued):

(h) Speed - Variable speed drive 3000 to 5000 sheets per hour.

d. DISCUSSION:

(1) In reference a. (1), the basic letter indicates the need for this project and directs the Engineer Board to prepare military characteristics. Subsequent endorsements indicate concurrence of HQ., Army Air Forces, HQ. Army Ground Forces and approval of the project by HQ., Army Service Forces.

(2) Agencies interested in this project, in addition to the Corps of Engineers are Army Air Forces and Army Ground Forces.

e. PROJECT PLAN:

(1) A pilot model press incorporating the desired features is being fabricated by a press manufacturer under a development contract.

(2) The pilot model will be subjected to engineering tests in the laboratory.

(3) Upon completion of engineering tests extended service tests will be conducted to determine the suitability of the press for airborne operations and for military field use.

(4) Upon completion of tests and necessary modifications, specifications will be prepared and submitted to the Chief of Engineers, together with recommendations regarding classification of equipment action, basis of issue and existing production facilities.

APPENDIX BProcurement Description, Press,  
Lithographic, Airborne Pilot Model

1. Sheet size 23" x 29" maximum, 11" x 17" minimum.
2. Printing area 21 5/8" x 28" or larger if practicable, but no smaller.
3. Stock range 9-lb onionskin to 6-ply (.024") card.
4. Register. The press to be designed for register equal to present 22" x 29" Big Chief press. The headstop shaft and all headstops to be made adjustable as one piece. An arrangement for swinging the printing plate for register without removing from plate clamps to be included.
5. Color printing and ink coverage equal to present 22" x 29" Big Chief press.
6. Plate size 27 1/2" x 28 5/8" x .012" approximately.
7. Blanket size 27" x 28 3/4" x 3-ply.
8. Plate cylinder undercut - .015".
9. Blanket cylinder undercut - .071".
10. Speed - Variable Speed Drive 3,000 to 5,000.
11. Motors. Drive - to be determined but 3 hp or less. Pump - to be determined but 1 hp or less.
12. Feed pile capacity. To be determined but approximately 21". Corner lift to be included.
13. Delivery pile capacity. To be determined but approximately 14".
14. Safety features. Press fully guarded with latest safety features.
15. Press designed so that feeder and press all one unit with low center of gravity and will oil or drip pan part of the permanent base.
16. Oil holes, special adjustments, etc., marked with instruction or name plates.
17. Wooden skids. Press to be equipped with permanent wooden skids treated if necessary to resist insect or fungus deterioration.
18. Eye bolts for lifting press to be installed.
19. Ink drying. Any auxiliary equipment for ink drying such as lamps, spray guns, etc., not included.
20. Weight. Press and skids - approximately 3,600 lb net.
21. Floor area. Approximately 51" wide by 48" long.
22. Height. Maximum height approximately 58".
23. Double action air pump of combination blast and suction to be included.
24. Rounding of the leading and tail edges of the plate cylinder to reduce the angle of bend to minimize damage to the plates.

Exhibit 1

25. Hardened screws and inserts for the plate cylinders to be included.

The Engineer Board  
Fort Belvoir, Virginia  
3 June 1946

APPENDIX B

REVISIONS OF PROCUREMENT DESCRIPTION

Revision to EXHIBIT "B" to Procurement Description, Press, Lithographic, Airborne Pilot Model, dated 3 June 1946, made by Modification No. 1 dated 28 July 1947 to Contract No. W-44-009 eng-405.

Paragraph 21 is deleted and the following new paragraph substituted therefor:

"21. Floor Area. Approximately 51" wide by 60" long. The base area including skids shall not exceed 48" wide by 48" long."

Revision to EXHIBIT "B" Procurement Description, Press, Lithographic Airborne Pilot Model, 3 June 1946, made by Modification No. 2 dated 19 September 1947 to Contract No. W-44-009 eng-405.

Paragraph 20 is deleted and the following new paragraph substituted therefor:

"20. Weight. Press and skids - approximately 4000 lb net."

Revision to EXHIBIT "B" Procurement Description, Press, Lithographic Airborne Pilot Model, dated 3 June 1946, made by Modification No. 3 dated 19 December 1947 to Contract No. W-44-009 eng-405.

a. Paragraph 12 is deleted and the following new paragraph substituted therefor:

"12. Feed Pile Capacity. To be determined but approximately 21"."

b. Paragraph 17 is deleted and the following new paragraph substituted therefor:

"17. Press to be equipped with a metal base which will serve as a skid with casters and a screw jack arrangement."

c. Paragraph 21 as changed by Modification No. 1, is deleted and the following new paragraph is substituted therefor:

"21. Floor Area. Approximately 51" wide by 60" long. The base area shall not exceed 48" wide by 48" long."

Revision to EXHIBIT "B" Procurement Description, Press, Lithographic Airborne Pilot Model, dated 3 June 1946, made by Modification No. 4 dated 31 March 1948 to Contract No. W-44-009 eng-405.

a. The following is added to paragraph 11

"motors are to operate on 110-120 volt, 60-cycle, single phase, alternating current."

b. Paragraph 13 is deleted and the following new paragraph substituted therefor:

"13. Delivery pile capacity. Minimum height 10 inches."

c. Paragraph 21 as changed by Modification No. 3, is deleted and the following new paragraph substituted therefor:

"21. Floor area, approximately 54" wide by 72" long. The base area shall not exceed 48" wide by 56" long.

APPENDIX C

## PURCHASE DESCRIPTION FOR SERVICE TEST MODELS

ENGINEER RESEARCH AND DEVELOPMENT LABORATORIES  
PURCHASE DESCRIPTION

1 February 1950

PRESS: LITHOGRAPHIC OFFSET; MOTOR DRIVEN, 110  
VOLT, 50-60 CYCLE, 1 PHASE, MOBILE,  
22 X 29 INCH SHEET SIZE

## 1. SCOPE

1.1 This purchase description covers a rotary, lithographic offset press for the lithographic reproduction of military maps and charts.

## 2. APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS

2.1 Specifications. - The following specifications, of the issue in effect on date of invitation for bids, form a part of this purchase description:

## MILITARY SPECIFICATIONS

JAN-T-704 - Treatment and Painting (For Construction and Engineering Equipment).

MIL-R- - (Proposed) Rollers, Lithographic Offset, Printing.

## U. S. ARMY SPECIFICATIONS

100-2 - Standard Specification for Marking Shipments by Contractors, including Corps of Engineers Supplement.

(Copies of specifications should be obtained from the procuring agency or as directed by that agency. Both the title and identifying number or symbol should be stipulated when requesting copies.)

2.2 Other publications. - The following publications of the issue in effect on date of invitation for bids, unless otherwise indicated form a part of this purchase description:

**MILITARY PUBLICATION****JAN-STD-1 - General Drawing Practice.**

(copies of JAN-STD-1 may be obtained from the procuring agency or as directed by that agency. Both the title and identifying number or symbol should be stipulated when requesting copies.)

**AMERICAN STANDARDS ASSOCIATION STANDARDS**

C1-1946 - National Electrical Code. (NEFCU Pamphlet 70.)

C50-1943 - Rotating Electrical Machinery.

(Applications for Copies of American Standards Association Standards should be addressed to the American Standards Association, 29 West 39th Street, New York 18, N. Y.)

**NATIONAL BUREAU OF STANDARDS PUBLICATION**

Handbook H28 - Screw Thread Standards for Federal Services.

(Copies of Handbook H28 may be obtained upon application, accompanied by money order, coupon, or cash, to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.)

**3. REQUIREMENTS**

**3.1 Description.** - This purchase description covers a motor-driven, single-color, rotary, lithographic offset press suitable for the reproduction of topographic and photo maps, or similar line and halftone subjects, printing in single color or in multicolor (by successive printings) in hairline register. The reproduction shall conform in size, register and detail with the form appearing on the plate without slur or gear streaks. The press shall be convenient and easy to operate and all controls and working surfaces shall be readily accessible for operation, servicing, and repairs. The press shall be designed and constructed as a single unit on a metal base which also serves as a skid and to withstand the strains, shock, and vibration incurred while in transit and in use in motorized field units. The skid and/or base shall be equipped with steel casters for portability and maneuverability. The press shall be provided with all appurtenances necessary for satisfactory operation even though not specifically mentioned herein.

**3.2 Temperature conditions.** - The lithographic press shall be capable of satisfactory performance in an approved type shelter in any ambient temperature from plus 50 to plus 125°F. It shall be capable of safe storage at temperatures from plus 160°F. (for

periods of at least 4 hours daily) to minus 80°F. (for periods of several days at a time).

3.3 Material. - Material shall be as specified herein. Material not definitely specified shall be of a good commercial quality entirely suitable for the purpose. Material shall be free from all defects and imperfections that might affect the serviceability of the finished product.

3.3.1 Corrosion-resisting materials. - In order to prevent deterioration due to corrosion, all bolts, screws, nuts, and washers shall be of a corrosion-resistant material approved by the bureau or agency concerned or of a material suitably treated to render them resistant to corrosion. Silver, corrosion-resisting steel, copper, brass, bronze, copper-nickel alloys, and nickel-copper alloys are considered satisfactory corrosion-resisting materials. The following treatments when applied in accordance with good commercial standards are approved corrosion-resistant treatments: Sherardizing, galvanizing, and electroplated cadmium, chromium, copper, nickel, silver, and zinc. Contacts of dissimilar metals shall be avoided as much as practicable in order to limit deterioration from electrolysis.

3.4 Standard products. - Components of the equipment shall be essentially the standard product of the manufacturer so that prompt and continuing service and delivery of spare parts may be assured. The component parts of the unit need not be the products of the same manufacturer.

3.5 Record drawings. - The contractor shall furnish the contracting officer a complete set of detailed pencil drawings of the equipment as furnished to the Government. Unless otherwise specified, the drawings shall be on paper furnished by the Government. The delination shall be in accordance with JAN-STD-1, and samples to be furnished (see 6.3) indicating density of lines, arrangement, and title block format.

3.6 Safety requirements. - All rotating, reciprocating, or projecting parts so located as to be hazardous to operating personnel shall be fully enclosed or properly guarded. All such safety devices covering delivery and ink distribution system shall be of transparent acrylate or methacrylate plastic.

3.7 Capacities and dimensions. - The press shall have the following capacities and shall conform to the following dimensions:

Paper stock size, minimum,	11 x 17 inches.
maximum,	22 $\frac{1}{2}$ x 29 inches.
Paper stock thickness, minimum,	9-lb onionskin (0.002 inch)
maximum,	6-ply card (0.024 inch)

Transfer size (maximum printing form),	22 1/8 x 29 inches.
Gripper margin, minimum,	5/16 inch.
Gripper margin, maximum,	3/8 inch.
Plate dimensions,	27 x 29 $\frac{1}{2}$ inches.
Blanket dimensions,	27 x 29 $\frac{1}{2}$ inches.
Undercut of plate cylinder,	0.015 inch.
Undercut of blanket cylinder,	0.071 inch.
Speed, sheets per hour, in hairline register on 22 x 29 inch, high wet-strength map paper (basis weight of 24-pounds per ream of 17 x 22 inch)	3000 to 5000.
Feeder, minimum pile,	22 inches.
Delivery, minimum pile,	11 inches
Drive motor, maximum,	2 h.p.
Feeder motor, maximum,	1 h.p.
Floor space, maximum,	76 x 60 inches.
Base size, maximum,	48 x 60 inches.
Over-all height, maximum,	62 inches.
Net weight, maximum,	4,500 pounds.

3.8 Registering mechanism. - The registering mechanism shall provide for three-point register, tumbler gripper type, with left and right side guides. Four front guides shall be provided, permanently mounted on a shaft to be adjustable as a unit and spaced to handle all sheet size requirements.

3.9 Feeder. - The feeder shall be of the sheet-by-sheet pile type, air-vacuum operated. The air and vacuum lines shall be equipped with gages and valves for determining and regulating the air and vacuum.

3.10 Press cylinders. - Press cylinders shall be prepared from seasoned or treated castings machined and ground to provide and maintain uniform cylindrical surfaces without underlying distortions or

depressions. The amount of undercutting shall be prominently stamped on the gap edge of each cylinder. The cylinders shall also have facilities to clamp and stretch the plate and blanket taut around the cylinders. The plate cylinder shall incorporate provisions to advance or retard the cylinder (with an indicator to scale the amount of movement), and to shift or swing the plate as may be required to obtain color register. Guide marks to indicate the gripper printing margin shall be engraved and extended beyond the sides of the plate on the plate cylinder to assist in registration. The plate clamping facilities shall allow for swinging the plate for register without removing clamps from plate. The plate and blanket cylinders shall be equipped with steel bearers, and all cylinders shall be provided with steel gears.

3.11 Ink distribution. - Ink distribution shall be even, and adequate to print, within the maximum speed specified, a solid black image over nearly the entire printing area without filling in local halftone areas. The ink distribution system shall consist of 14 rollers as follows:

3 ea - Form synthetic rubber covered	- 2 3/16-inch dia.
2 ea - Oscillating, steel	- 2 1/4-inch dia.
2 ea - Oscillating, steel	- 2 1/2-inch dia.
1 ea - Fountain, steel	- 2 1/2-inch dia.
1 ea - Rider, steel	- 1 5/16-inch dia.
3 ea - Distribution, synthetic rubber covered	- 1 5/8-inch dia.
1 ea - Ductor, synthetic rubber covered	- 1 5/8-inch dia.
1 ea - Distribution, synthetic rubber covered	- 2 3/16-inch dia.

3.11.1 Synthetic rubber roller covering. - The covering of the rollers shall conform to the proposed Specification on Rollers, Lithographic, Offset, Printing, Type I, for Class A and B.

3.11.2 Ink fountain. - The ink fountain shall be of a calibrated type and shall be approved by the contracting officer.

3.12 Wash-up attachment. - Each press shall be equipped with a complete, wash-up attachment as manufactured by William Gegenheimer, Brooklyn, N. Y. equal to the Baldwin type which will satisfactorily remove the ink from the rollers (utilizing ink solvents) in cleaning up the press. The blade shall be of a fibre composition and readily replaceable.

3.13 Water distribution. - The water distribution system shall be of a design that will control the quantity and ensure uniform distribution of water required for lithographic presswork. The

system shall include two form dampening rollers and one ductor roller covered with synthetic rubber specified in 3.11.1 and only one molleton sleeve cover. At least 4 water stop wipers in holders, for localized reduction of water, shall be provided.

3.14 Speed regulation. - The speed regulation shall be by means of a variable pitch pulley, similar and equal to model 28-H10-A73 as manufactured by Reeves Pulley Co., Comombus, Indiana.

3.15 Electrical equipment. - All electrical equipment shall be designed and furnished for 110-volt, 50-60 cycle, single-phase operation. Operating performance shall be based on 60-cycle current, but equipment shall also function satisfactorily on 50-cycle supply. All required electrical switches and accessories shall be furnished, fully wired to a terminal box, with suitable wire for interconnections where necessary. The terminal box shall be equipped with a 60-ampere two-pole receptacle similar and equal to Russell & Stoll No. 3122, and shall be provided with a corresponding plug so that installation can be accomplished with materials supplied, and operation effected by connecting to the power line. All electrical equipment and wiring shall conform to Standard Cl-1946. Controls shall be standard start-stop push buttons. Forward inching shall be by push button, clutch, or hand, and reverse inching by hand.

3.16 Bearings and bushings. - Where practicable, all shafts shall be mounted on bronze bushings or anti-friction bearings.

3.17 Lubrication. - All moving parts shall be provided with suitable means of lubrication.

3.17.1 Lubricants. - The press shall be designed to operate efficiently and satisfactorily when lubricated with standard commercially-available lubricants.

3.17.2 Grease fittings. - Grease fittings shall be located in accessible, protected positions. A bright red circle shall be painted around each lubricating point.

3.18 Lifting attachments. - The equipment shall be provided with suitable lifting attachments to enable the equipment to be lifted in its normal position. Where practicable, one attachment of sufficient capacity to carry the total weight shall be used. Where more than one attachment is required, each attachment, if practicable, shall be of sufficient capacity to carry the total weight. The eye of each lifting attachment shall be not less than 3 inches in diameter. The lifting attachments shall be capable of withstanding any handling conditions which might be encountered, such as rapid lowering and violent braking of load.

3.19 Manufacturer's identification. - Components of the equipment shall bear the manufacturer's name or trade-mark on a name plate securely affixed in a conspicuous place. In lieu of the name plate, the manufacturer's name or trade-mark may be cast integral with, stamped, or otherwise permanently marked upon the components of the equipment.

3.20 Instruction plates. - Each unit of equipment shall be equipped with instruction plates, suitably located, describing any special or important procedures to be followed in operating and servicing the equipment. Plates shall be of copper-base alloy.

3.21 Treatment and painting. - All parts of the equipment normally painted in good commercial practice shall be treated and painted in accordance with the applicable requirements of Specification JAN-T-704, type I, except that electrical equipment shall be painted in accordance with the standard practice of the manufacturer.

3.22 Technical publications to accompany equipment. - Such technical publications as are specified shall be furnished. (See 6.2.)

3.23 Spare parts and maintenance tools. - Such spare parts and maintenance tools as are specified shall be furnished. (See 6.2.)

3.24 Tool box. - The equipment shall be provided with a tool box made of metal not less than 0.0747 inch in nominal thickness, or of wood construction as approved by the contracting officer. The tool box shall have a hinged lid and a truck drawbolt of a type that will keep the lid closed when subjected to vibration or rough travel.

3.25 Workmanship. - Workmanship shall be of the highest grade throughout and in accordance with good commercial practice for this type of equipment.

3.25.1 Metal fabrication. - Metal used in the fabrication of the equipment shall be free from kinks and sharp bends. The straightening of material shall be done by methods that will not cause injury to the metal. Shearing and chipping shall be done neatly and accurately. Corners shall be square and true. Flame cutting, using a tip suitable for the thickness of metal, may be employed instead of shearing or sawing. Burned surfaces of flame-cut material shall be ground or machined sufficiently to remove ash and cooling checks. All bends of a major character shall be made with metal dies or fixtures in order to insure uniformity of size and shape. Precautions shall be taken to avoid overheating, and heated metal shall be allowed to cool slowly.

3.25.2 Bolted connections. - Bolt holes shall be accurately punched or drilled and shall have the burrs removed. Washers or lock washers shall be provided in accordance with good commercial practice, and all bolts, nuts, and screws shall be tight.

3.25.3 Riveted connections. - Rivet holes shall be accurately punched or drilled and shall have the burrs removed. Rivet heads, when not countersunk or flattened, shall be of approved shape and of uniform size for the same diameter of rivet. Rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

3.25.4 Machine work. - Tolerances and gages for metal fits shall conform to the limitations specified herein, and otherwise to the standards of good commercial practice. Finished contact and bearing surfaces shall be true and exact.

#### 4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 Tests. - The equipment and the preparation for delivery thereof shall be given such tests as may be necessary to determine conformance with the requirements of this purchase description.

#### 5. PREPARATION FOR DELIVERY

5.1 Packing. - Packing for shipment shall be in accordance with instructions issued by the procuring agency.

5.2 Marking. - Marking for shipment shall conform to Specification 100-2, and the Corps of Engineers Supplement thereto, except as may be modified by the procuring agency.

#### 6. NOTES

6.1 Use. - The rotary lithographic offset press is intended for use in military operations as a light-weight, compact, lithographic offset press easily transported by air or motorized mapping vans to any location as an assembled unit.

6.2 Ordering data. - Purchasers should include in the invitation for bids and contract or order the following information:

- (a) Title, number, and date of purchase description.
- (b) Technical publications required. (See 3.22.)
- (c) Applicable list of spare parts and maintenance tools. (See 3.23.)
- (d) Instructions regarding preparation for delivery. (See 5.1.)

6.3 When record drawings are required, the contracting officer should furnish the contractor with suitable drawing paper and sample drawings. (See 3.5.)

6.4 The invitation for bids should contain the following clause:

"Exceptions. - The bidder shall furnish a statement giving a complete description of all points wherein the equipment he proposes to furnish does not comply with the purchase description, as well as any exceptions he may take to the purchase description. Failure to furnish such a statement will be interpreted to mean that the bidder agrees to meet all requirements of the purchase description."

6.5 Invitations for bids and contracts or orders should contain the following guaranty clause, except in those instances where it is determined that the inclusion of the guaranty clause would not be to the best interests of the Government:

"Equipment furnished under this purchase description shall be guaranteed for a period of one year after delivery against defective materials, design, and workmanship. In the event of failure of any part or parts during this period, owing to these causes, the affected part or parts shall be replaced promptly upon notice by the Government with new parts delivered f.o.b. the site of the equipment. All replacements shall be furnished without extra cost to the Government. Statements confirming this guaranty shall be made a part of the bid submitted."

6.6 This purchase description is an ad interim description intended for procurement of an experimental item of equipment. It does not necessarily include requirements recommended by the Engineer Research and Development Laboratories or the Corps of Engineers for quantity procurement of this item for general use or issue.

Notice: - The Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.